

The Learning Company

Gertrude's Secrets

Builds Early Thinking Skills

Grades: Kindergarten–4th

Teacher's Guide and Student Activities

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Preface

This manual is designed to meet the needs of teachers who wish to introduce Early Thinking Skills to their students using the Gertrude's Secrets software program. Below is a description of the sections in the manual.

Early Thinking Skills Scope and Sequence Chart, Gertrude's Secrets correlates the mathematical concepts, or strands, presented in the on-line games and off-line activities to the grade levels where these concepts are commonly taught. Each game and activity is referenced by page number.

Teaching with Computers addresses several issues of concern to teachers. Here topics such as the teacher's role, setting up the workspace, and incorporating the computer into the curriculum are discussed.

Stepping Through Gertrude's Secrets provides an overview of the concepts and skills which can be developed by GERTRUDE'S SECRETS. The Learning List enumerates these for each game. This section is designed to help the teacher prepare to introduce the program to students. It may be used without a computer for those teachers who prepare their lessons at home and do not have a computer available. Each section of the software program is presented with a focus on objectives, on-line presentation, and off-line activities. The off-line activities are intended to strengthen and generalize the concepts and skills developed in each tutorial. The Evaluation page includes questions to test students' understanding of the games, and the Class Record Form can be used to monitor students' progress through the program. Answers to the Activity Sheets conclude this section.

The **Activity Sheets** are blackline masters for use with the off-line activities. They may be used as evaluation instruments of program objectives.

The **Appendix** includes Special Keys, which provides a quick reference to the keys needed to play GERTRUDE'S SECRETS. The Glossary presents terms that are important in this program. **Keeping Current** gives the names of valuable books, publications, and organizations that are national in scope and can help the teacher who wishes to learn more about computers and the educational applications of computers.

It is our hope that this manual meets the needs of teachers who use it, and we welcome suggestions, comments, and ideas about its effectiveness.

Early Thinking Skills Scope & Sequence Chart

Gertrude's Secrets

GRADE LEVEL

STRANDS	Kindergarten	Grade 1	Grade 2	Grade 3
NON-NUMBER ACTIVITIES <ul style="list-style-type: none">• First, last• Describing attributes• Find the one that is different• Classifying	Train Puzzles: T-33, 34, 35 Difference Train Puzzles: T-35,36,37,38,39; S-14,15,16,17,18,19 Gertrude's Puzzle Pieces: T-16, 17; S-5 Match My Hat: T-42, 43; S-20 Match Me: T-18, S-5 Train Puzzles: T-33, 34, 35 1 & 2 Difference Train Puzzles: T-35,36,37,38,39; S-14,15,16,17, 18,19 Array Puzzles: T-19,20,21 3X3 Array Puzzle: T-21,22,23; S-6,7 4x4 Array Puzzle: T-23,24; S-8,9 Loop Puzzles: T-26,27,28 1&2 Loop Puzzles: T-26,27,28,29,30 S-10,11,12,13 Castle Game: T-32 Match My Hat: T-42, 43; S-20	 <		

Legend:

T = Teacher page

S = Student Activity Sheet

Early Thinking Skills Scope & Sequence Chart Cont.

Gertrude's Secrets

GRADE LEVEL

STRANDS	Kindergarten	Grade 1	Grade 2	Grade 3
PROBLEM-SOLVING/ APPLICATIONS <ul style="list-style-type: none"> Strategies <ul style="list-style-type: none"> Use logical reasoning/Find a pattern/Guess and check Make a list Map 	Loop Puzzles: T-26,27,28 1&2 Loop Puzzles: T-28,29,30; S-5,10,11,12,13,20,21 The Castle Game: T-32 Match My Hat: T-42; S-20 Make a Rule! Guess a Rule!: T-44; S-20 Hat in the Loop: T-44,45; S-10,12,20 Alphabet Soup in a Loop; T-46; S-21,10,12 People Sets: T-47; S-22 Array Puzzles: T-19,20,21 3x3 Array Puzzle: T-21,22,23; S-5,6,7 4x4 Array Puzzle: T-23; S-5,8	People Sets: T-47; S-22 Attributes & Sets: T-48		The Tutorial: T-11,12 Map of World: T-13,S-2,3
GEOMETRY <ul style="list-style-type: none"> Inside, outside Patterns Symmetry/Lines of Symmetry Plane figures/shape perception 	Loop Puzzles: T-26,27,28 1&2 Loop Puzzles: T-28,29;S-10,11, 12,13 T-16; S-4	Visiting the Storeroom: T-15,16 Gertrude's Puzzle Pieces: Gertrude's Playing Pieces T-17; S-5 Array Puzzles: T-19,20,21 3x3 Array Puzzle: T-21-3; S-5,6,7 4x4 Array Puzzle: T-23; S-5,8 Alphabet Soup in a Loop T-46,47; S-21,10,12 Visiting the Storeroom: T-15,16 Gertrude's Puzzle Pieces: T-16,17; S-4 Gertrude's Playing Pieces: T-17; S-5 Match Me: T-18; S-5	Alphabet Soup in a Loop: T-46; S-21	

Teaching with Computers

A Teacher's Role

With increasing numbers of computers in schools, we find ourselves asking how we can effectively use a new teaching tool in the classroom. What is the role of the teacher who uses computers?

Your role as a teacher is critical in a student's computer experience. You can open exciting new doors of learning by selecting software that challenges students while providing them with ample opportunities for success. You can help students create bridges between the classroom curriculum and computer skills and concepts. You can be a role model demonstrating openness and curiosity while introducing new ways to learn.

Today many young people have computers at home, and you may find that some of them are very skilled users. If you are just learning about computers yourself, you may find that some of your students are more knowledgeable about the use of computers. You can harness this expertise and provide your computer-literate students with the chance to help you and other students learn about computers. By doing this you can give these students the gift of heightened self-esteem while gaining valuable assistants in your role as the classroom manager.

You will find that most children welcome the opportunity to use a computer. Most will quickly pick up terms and procedures. With a little guidance, they all can become competent computer users.

Your role in integrating the computer in your classroom is much the same as it is when introducing any other learning tool. Once it is selected, you must prepare to use it. Then you help your students gain mastery. Your challenge becomes one of using the new learning tool in a creative and productive way. It takes the same amount of time and planning that goes into developing any new course and selecting the curriculum materials.

When students, especially younger ones, begin to use a computer, they will often need help with directions. You can provide those directions to the entire class, to groups, or to individuals. Once the students master basic directions, they can work alone or in groups. Children learn a great deal from working with other children. You should encourage them to share information.

In many ways, you can view the computer as a superb teacher's aide. Students can use the computer and learn at their own pace. With the right kind of software, children can feel safe taking intel-

Teaching with Computers

lectual risks without fear of negative judgment for mistakes. Skills and concepts can be introduced that traditionally would not be taught until much higher grades. Enrichment opportunities can be provided for any student.

Although the computer is a powerful tool for learning, it can never replace human creativity and sensitivity. The computer cannot know the skills that each of your students needs to master, nor can it know students' strengths and weaknesses. Only you, the creative teacher, can choose the software that will benefit your students, assign needed lessons, and make the critical subjective judgments that will turn the key and free a student's mind to learn.

Hardware Management

Setting Up Space: Create a Work Station Your school or classroom may be one in which a computer is already established. If so, this sections may not pertain to you. However, if you are introducing a computer to your students for the first time, the following suggestions may help.

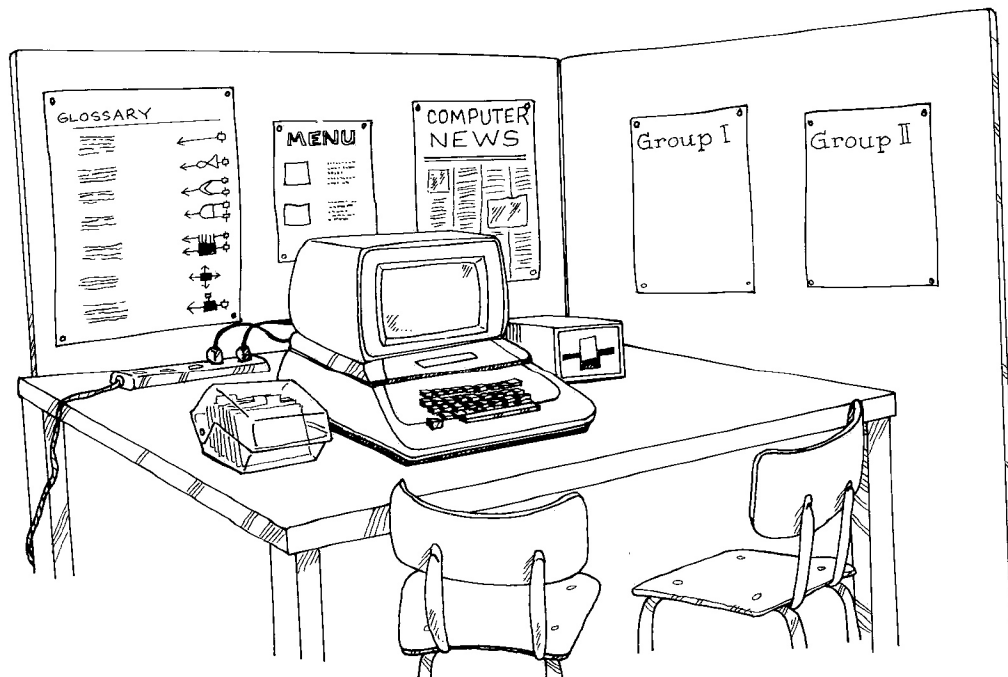
Introducing a computer to your students will probably be a very exciting experience for everyone. Set aside a special place where students can explore and use the computer. It can be a place where they learn to care for the computer without fear of damaging an expensive machine. It can provide a place to focus on computer work, and a place to display materials related to the concepts and skills presented by the computer programs.

Computer work stations may have the following things in common: an enclosed computer table (the enclosure provides display space); enough chairs for groups of students; and room for the entire class to sit on the floor and view the computer screen.

To set up a work station you will need the following items:

- *A table.* If your computer is not on a portable cart, a table will be needed. It may be small enough to hold just one computer or large enough to hold more. It might have space for another student who is waiting for a turn at the computer.
- *The computer system(s).* For each system you will need a computer, a disk drive, and a color monitor (color recommended); a power strip (power bus) with an on/off switch is suggested.

- *A container to hold the disks.* You can purchase special disk holders at computer stores or at some educational supply houses. A covered box works almost as well if disks can stand up inside it.
- *Some way of enclosing the space.* Placing the work station in a corner of the room is an easy solution. If you don't have an extra corner you can construct a 3-part standing screen by using fiber board, heavy cardboard (a refrigerator carton), or wood. If you choose fiber board or wood you will need hinging devices. If you use heavy cardboard you will need reinforcements on the bottom to make it stand upright. An alternative could be to turn the monitor away from the view of the classroom.
- *Display space.* You can hang bulletin boards right on the walls if your work station is in a corner. A wooden enclosure can be covered with cork or fiber board. If you use fiber board or heavy cardboard for your work station you can post materials directly on the station's enclosing walls.
- *Materials for working on the bulletin board.* Pens, pencils, paper, erasers, pushpins, tape, string, and containers to hold such materials are items to consider. You should place these items distant from the computer or make them unavailable to students to avoid tempting them to experiment with the keyboard.



Setting Up the Computer Setting up the computer can become a classroom adventure. In our experience, even very young children can become competent at setting up and taking down computer systems. In fact, we know of some classrooms where the children instruct the teachers.

Discuss ahead of time your ground rules for using the computer. Warn students that items such as food, paint, clay, magnets, paper clips, or any liquid that might spill into the computer can damage the computer unit. You may even want to have a guest speaker discuss this and answer student questions.

The manual that comes with your computer will explain the details of how to set up your specific machine. However, we are including some tips learned over time.

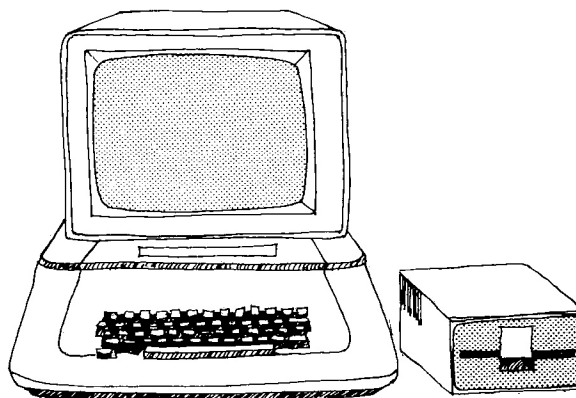
- *Ground your computer.* Computers have three-prong plugs and must be plugged into a wall socket that is actually grounded.
- *Use a power strip with an on/off switch.* Instead of plugging your computer directly into the wall socket, consider using a power strip. It has multiple sockets and can compensate somewhat for lack of sufficient electrical outlets. It serves the purpose of an extension cord, but is sturdier. Using the on/off switch can save the computer's power switch.
- *If you are using a television you will need a frequency modulator.* Frequency modulators to convert the TV into a computer monitor are inexpensive at computer supply stores. They attach to the TV's antenna leads and, by a cable, to the computer. See the instructions that come with the frequency modulator. Regular monitors do not need frequency modulators.
- *Open up your computer.* You can do this with most, but not all, computers. Look inside. This is a good time to introduce your students to computer terms. They can see the silicon chips. The large board that everything else is plugged into is called the mother board. The disk drive has a peripheral card that is plugged into a specific slot. There is also a special port for a joystick if you will be using one. See your machine manuals.
- *Handle disks with care.* Hold disks only by the label or the black jacket and teach your students to do the same because oil on fingers can get on the surface of the disks. Disks can be damaged easily by pressure (writing on the label with pen or pencil), heat (sunlight, heaters, storage areas), magnetic fields

(magnets, paper clips stored in magnetic containers, being placed on or around disk drives, telephones, fans, motors, loud speakers, air conditioners), bending.

- *Cover your computer.* The computer hardware may need special attention, too. Large plastic or cloth sheets may be used to cover the computer to protect it from dust when not in use.

Tell students that *starting-up* means putting the disk into the disk drive, closing the door, and starting the computer. Explain to students that to put the disk into the disk drive, they must slide it gently until it stops. Jamming it roughly or pushing it in too far can result in a damaged disk. When one of the two red lights goes out insert the disk. Close the disk drive. Turn on the computer and the monitor. The disk drive may make a whirring or clicking sound as it is loading. A red light on the disk drive will light until the loading is finished. Tell students the red light is like a stop sign; do not open the door to remove a disk or to put another one in when the light is on.

You can explain to your students that the disk is spinning very fast inside the disk drive. Heads in the disk drive resemble those on a tape recorder and they read the disk's information. The information travels through the wide cable running from the disk drive to the computer and is stored there in RAM (random access memory) chips. Ask students to keep the doors to the disk drives closed when not in use; this keeps the heads from getting dirty.



Classroom Management Tips

Here are a few tips that have been found useful for classroom presentations.

One Computer: Everyone Plays At the present, most classrooms have only one computer. In fact, the teacher who has access to one computer that does not need to be shared is considered quite fortunate. How to manage this resource is of some concern.

Computer programs work very well in classroom presentations. The main limitation is having a large enough screen so that everyone can see. Teachers can introduce the programs to the entire class at the same time. In this way, students know what to expect and have a better idea of what they need to do, when they work individually at the computer. One presentation that works well is to have students take turns running the programs and playing the games as the rest of the class watch and advise.

For introducing a puzzle in GERTRUDE'S SECRETS, the classroom presentation has the advantage of familiarizing the whole class with the puzzle at the same time. Teachers may choose a student to demonstrate the new puzzle while the rest of the class watch and advise. The puzzle can be solved several times, using a different student each time. Once everyone in the class understands how the puzzle is solved, they are ready to play with minimal supervision.

As you work with your class you will discover new ways to encourage student involvement. The students will make interesting suggestions as well.

One computer and one disk need not be a limitation. It can be an opportunity for the whole class to participate at once. Classroom presentations can bring more excitement and delight to playing the games than might be achieved by students playing alone.

Two at the Computer: Parallel Play Another way to manage a classroom presentation is to have one or two students solving the puzzle at the computer while the rest of the class is involved in an off-line activity. With shorter, simple puzzles, all of the students may have an opportunity to play during one class presentation. Some of the activities in this manual are suggested off-line activities. They can be used to extend the concepts developed in the computer puzzles.

Stepping Through Gertrude's Secrets

GERTRUDE'S SECRETS is an exploratory game in which students solve puzzles and manipulate computer graphics in the special environment of Gertrude's world. This world can be thought of in terms of a house with many rooms. Students move a cursor from room to room where they solve three kinds of puzzles. To do so, students will read instructions, see sample puzzles, and change the playing pieces used to solve these puzzles.

Gertrude's world can be explored in many different ways. There is no prescribed order for solving the puzzles or investigating the rooms. However, for the purposes of this guide, some sequence had to be imposed. The order in which the puzzles and rooms are discussed here represent one logical, instructional approach that can be used to introduce the program to your class. Of course, there are alternate sequences that may work equally well with your class. But we suggest that you introduce the three kinds of puzzles first, using only the primary playing pieces. The New Puzzle Piece Room and the Shape-Edit Room could then be explored, and students could go back to each puzzle using the new playing pieces they selected or created. The Treasure Room can be investigated any time after a puzzle has been correctly solved.

If you decide on an approach other than the one used in this guide, you will still want to begin with the "Tutorial" and a visit to the Storeroom. Here, students learn how to move in the game and become familiar with the primary playing pieces. These are prerequisites to success with GERTRUDE'S SECRETS.

Many of the off-line activities reinforce students' understanding of the relationship between shape and color of the primary playing pieces used to solve the puzzles. They do this through the use of attribute cards and game boards.

A set of geometric shape cards that duplicate the shapes of the playing pieces in GERTRUDE'S SECRETS is provided. These cards can be used to play many of the games suggested in the Off-Line Activities. They can also aid students in solving the puzzles on the computer.

The game boards duplicate on paper each of the puzzles in GERTRUDE'S SECRETS. Since the game boards and cards may be used for more than one activity, you may want to mount the copies on cardboard or poster-board. Covering them with clear contact paper will keep them clean and intact throughout many activities.

Learning and the GERTRUDE'S SECRETS Courseware

GERTRUDE'S SECRETS is designed to help students sharpen their classification and logical-thinking skills. Students learn to discriminate between objects, classify objects by two attributes (shape and color), and discover rules and common relationships that tie together objects and sets of objects. It provides a playful and exploratory introduction to elementary set theory, and helps polish problem-solving skills.

Students need to build logical structures between objects and sets of objects to make sense of their world. In the process of growing up, most children begin to notice similarities and differences between objects. Then they attach names to the objects to further identify and describe them. These early classification skills establish patterns and relationships among the objects in the child's world, and provide an early framework for the logical thinking which will develop later.

In GERTRUDE'S SECRETS, students sort through puzzle pieces and choose those they believe fit within a certain class (fit a certain "rule of belonging") to solve puzzles. There are three types of puzzles in the program and each type has easier and harder versions. To solve the puzzles, students must notice the properties that specific puzzle pieces have in common and properties that distinguish them from each other.

Students give classification a finer structure as they discriminate between classes of shapes (diamonds, hexagons, triangles, rectangles) and classes of colors (orange, blue, green, purple). The student soon learns that sometimes the various pieces must be distinguished by their differences and sometimes by their similarities. Students manipulate and classify these pieces in various configurations.

To solve the puzzles, the student must not only be able to classify objects but also develop finer and finer strategies for solving the different types of puzzles. This improves the student's problem-solving skills.

The student can spend as long as needed to solve any given puzzle. Some students may find some puzzles quite difficult to solve and others fairly easy. The computer provides gentle feedback if puzzle pieces are misplaced. If a piece does not fit the rule of belonging for any puzzle, it floats out of the puzzle; if it does fit, it stays inside the puzzle.

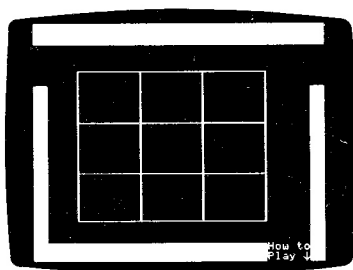
Playing with GERTRUDE'S SECRETS can be an exciting, satisfying experience for any student. GERTRUDE'S SECRETS is intended to propel children into the exciting process of achieving mastery in solving the problems presented; mastery that is achieved because their minds work well.

The Learning List

Games

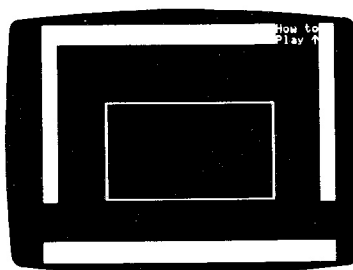
Concepts and Skills Presented

The Array Puzzles



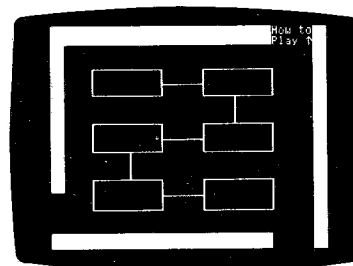
- Discriminating patterns of shapes and colors.
- Using arrays (preparation for grids).
- Following directions.
- Ordering.
- Deductive reasoning and problem-solving.
- Inferring patterns and rules.

The Loop Puzzles



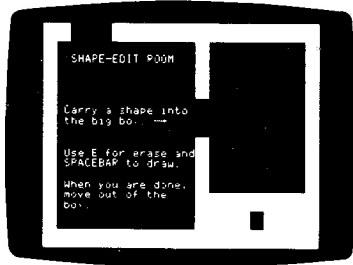
- Discriminating shapes and colors.
- Solving a loop (Venn diagram) puzzle.
- Following directions.
- Categorizing and inferring patterns and rules.
- Reasoning deductively and problem-solving.

The Train Puzzles



- Discriminating similarities and differences.
- Following directions.
- Recognizing relationships between objects.
- Sequencing.
- Reasoning deductively and problem-solving.
- Discovering multiple solutions.

The Shape-Edit Room



- Using computer graphic techniques.
- Thinking creatively.

Starting Up the Program

First, make sure that all your students can see the screen and, if possible, the computer keyboard. Then choose one student to put the GERTRUDE'S SECRETS disk in the disk drive, close the door, and turn on the computer. (If you are using a Commodore computer, turn on your system first, then put the disk in the disk drive.) On an Apple IIe, be sure the CAPS LOCK key is down. GERTRUDE'S SECRETS loads automatically on Apple, IBM, and Tandy 1000 computers. On a Commodore computer, type **LOAD TLC",8,1** and press **RETURN**. The program loads when you see the prompt "SEARCHING FOR TLC, LOADING."

The first room of GERTRUDE'S SECRETS appears each time the program is loaded. To introduce the game to beginners, have one student move the cursor through the door on the right. The student then enters the "Tutorial" that illustrates how to make things happen in Gertrude's world. The "Tutorial" can not only be used to introduce the program for the first time, but also to review how to move in the game.

To go directly to the puzzles, have one student pick up the flower and put it in the planter box. By doing this, the student has demonstrated the ability to pick up, move, and drop an object.

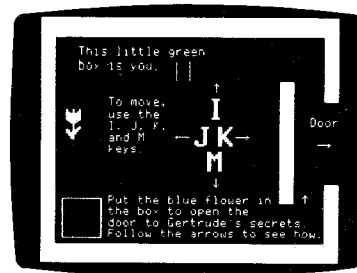
Before students begin the "Tutorial" or the puzzles, explain that pressing the **ESC** key stops the game. Point out the location of this key on the keyboard. When **ESC** is pressed, students will be prompted to insert another disk or to press **RETURN** to return to GERTRUDE'S SECRETS.

FL	on Commodore
←	on IBM
ENTER	on Tandy 1000

The Tutorial

Objectives

- Moving through the rooms.
- Following instructions in each room.
- Picking up and dropping objects.
- Turning on and off the sound.



The "Tutorial" introduces students to concepts they will need to know in order to play GERTRUDE'S SECRETS and prepares them for using these concepts when playing with GERTRUDE'S PUZZLES. The "Tutorial" can be used to introduce the program for the first time, or to review how to move in the game.

On-Line Presentation

After the program has been loaded and the first room appears, choose one student to begin the "Tutorial" while the rest of the class watch. Explain that Gertrude's world is like a large house with many rooms and that this "Tutorial" is like a tour of the house.

To begin, have the students use the keys to move the cursor through the door on the right of the screen.

Playing the Game By following the instructions on the screen, the student moves through each of the rooms in the "Tutorial."

Explain the following points to the class:

- The motion of a small, square, green cursor on the screen is controlled by using the **I**, **J**, **K**, and **M** (movement) keys on the keyboard, or by using the handle of a joystick.
- Gertrude's world is a series of rooms that have walls and doors. Players can move the cursor through the doors into adjoining rooms, but they cannot move through walls.
- Objects can be picked up and dropped in the rooms by pressing the **SPACEBAR** on the keyboard, or one of the buttons on a joystick.

arrow keys on IBM
and Tandy 1000

The Tutorial

- Holding down the **I**, **J**, **K**, and **M** keys (with **REPT** on Apple II+ computers) or the joystick handle makes the cursor move continuously.
- The **CTRL** and **G** keys turn the sound off and on.
- Holding down the control **CTRL** key while pressing a movement key moves the cursor short distances.

arrow keys on IBM
and Tandy 1000

CONTROL **S**
on Commodore

↑ on IBM
SHIFT on Tandy 1000

Encourage the whole class to participate by reading the instructions out loud and taking turns controlling the cursor in the different rooms.

The last room of the "Tutorial" is similar to the first room of GERTRUDE'S SECRETS. By picking up the flower and dropping it into the planter box, students enter the instruction room of GERTRUDE'S SECRETS. From there, they can enter Gertrude's game world.

The first four off-line activities may be used to evaluate students' understanding of the tasks presented in the "Tutorial." Whether you use these for evaluation purposes or not, be sure to distribute the Map of Gertrude's World before entering the game world. The map will help orient students to Gertrude's rooms and aid them in finding their way through GERTRUDE'S SECRETS.

Off-Line Activities

GETTING AROUND IN GERTRUDE'S WORLD This activity is designed to test students' understanding of the concepts presented in the "Tutorial." Students answer questions about the use of various keys and their functions in Gertrude's world. The handout can be used for evaluation purposes, or, once completed, as a reference for students when they need review.

You need:

- One activity sheet (page 1) for each student.
- Pencils and crayons.
- Rulers.

Distribute page 1 to the class. Be sure they understand the directions. You may wish to read the instructions out loud. You may also

Getting Around in Gertrude's World

NAME _____

Keyboard Commands

Write the name of the correct key beside each sentence.

1. It moves the cursor UP. _____
2. It moves the cursor LEFT. _____
3. It moves the cursor RIGHT. _____
4. It moves the cursor DOWN. _____
5. It picks up and drops objects. _____

Fill in the blanks to complete the sentences below.

wish to ask students to extend this activity by drawing a map of the rooms in the "Tutorial." It might be best to have the students:

- Draw 10 boxes on the page to represent the rooms in the "Tutorial."
- Indicate where the doors are found in each room.
- Label those entrances and exits appropriately.
- Add color to the walls of any of the rooms if special colors are indicated.
- Draw flowers, boxes, hats, faces, arrows, and any other items to make the maps resemble the rooms in the Tutorial.
- Write a brief statement about what they learned in each room.

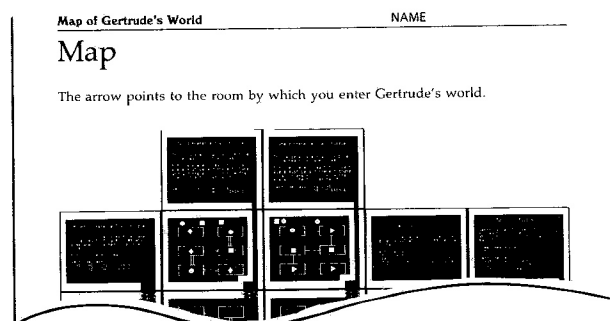
MAP OF GERTRUDE'S WORLD This activity helps orient students to Gertrude's game world, acquaints them with the locations of the rooms, and illustrates the puzzle designs. Once students are familiar with the "Tutorial," they recognize that the doors in the rooms lead to adjoining rooms. They use this concept to explore the rooms on the map, and answer the questions on the student hand-out.

You need:

- Two activity sheets (pages 2 and 3) for each student.
- Pencils.

Distribute pages 2 and 3 to the class. Be sure they understand the directions. You may wish to have a student volunteer to explain the instructions to the class.

By introducing the map before students explore the rooms on the computer, students will need less time locating rooms. The Map of Gertrude's World can be used for evaluation purposes. It can also be used as a student reference during all the classroom presentations since all the rooms are numbered for easy identification.



Map of Gertrude's World

NAME _____

Quiz

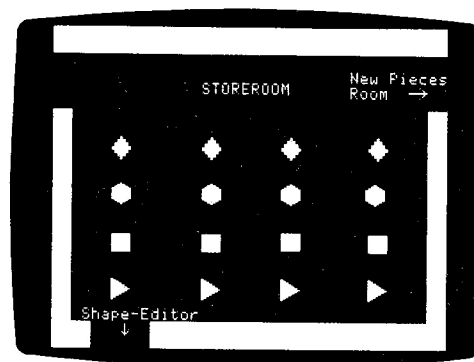
Use the Map of Gertrude's World to answer the questions below.

1. In which room is Gertrude resting in her nest? _____
2. From Room 1, circle the direction you need to go to find Gertrude.
RIGHT LEFT UP DOWN
3. How many doors does Gertrude's Room have? _____
4. How many Loop puzzles are there? _____
5. How many Train puzzles are there? _____
6. How many Array puzzles are there? _____

Gertrude's Puzzle Pieces and the Storeroom

Objectives

- Becoming familiar with the layout of the rooms.
- Learning how Gertrude behaves.
- Practicing tasks presented in the "Tutorial."
- Working with the primary playing pieces used to solve the puzzles.



Students learn that there are seven puzzle rooms: two rooms of loop puzzles, three rooms of train puzzles, and two rooms of array puzzles. The first room of each kind of puzzle contains the easier of the two or three puzzles. For example, the one-loop puzzle is in Room 4; the two-loop puzzle, a harder game, is in Room 5. Students also learn that when Gertrude is carried from her nest into one of the puzzle rooms and released, she flies away and returns with a set of playing pieces. The primary set of playing pieces used to solve the puzzles contains four diamonds, hexagons, squares, and triangles in four different colors: orange, green, blue, and purple. These playing pieces are kept in the Storeroom. Students also discover that when pieces are carried into a puzzle room, those same pieces are missing from the Storeroom, a fact they can verify by visiting both rooms. It is this kind of detail that makes the world of GERTRUDE'S SECRETS seem so real.

It is important that students understand the similarities and differences between the shapes and colors of the playing pieces. This understanding is necessary when solving the puzzles which use "one-difference" rules (shape or color) and "two-difference" rules (shape and color). The off-line activities in this section help develop recognition of these concepts.

On-Line Presentation

After the program has been loaded and the first room of GERTRUDE'S SECRETS appears, ask one student to pick up the flower, drop it inside the planter box, and move up to Gertrude's Room. The first room of the game world appears.

If you have not already done so, distribute copies of the Map of Gertrude's World. Have the class identify the room that now appears on the screen (Room 1). (You may wish to refer students to the map for identification of rooms shown on the screen throughout the classroom presentation.)

Read the text in Room 1 aloud to the class. Explain to students that they first need to find Gertrude resting in her nest. Then they can carry her to the puzzle rooms where she will show what she can do.

Have one student move the cursor through the empty Treasure Room (Room 2). Tell students that when they solve puzzles, their treasures will be stored there. Then have the student follow the arrow to Gertrude's Room, Room 3. This is the central room in Gertrude's world. From here, students can enter all the puzzle rooms.

Have students take turns picking up Gertrude, carrying her to the other puzzle rooms, and releasing her. Help them discover that each time she flies away, Gertrude brings back a different set of playing pieces. Point out that the number of pieces will always be the same for a particular puzzle.

You may vary the classroom presentation of "Gertrude's Puzzle Pieces and the Storeroom" by distributing to the class the third activity sheet. For each room that Gertrude visits on the screen, have students record on their activity sheets the shapes and colors of the playing pieces she brings.

Visiting the Storeroom Once students are familiar with Gertrude's behavior, they are ready for a closer look at the playing pieces. Ask one student to pick up Gertrude from her nest and carry her through the door at the bottom of Gertrude's Room to the Treasure Room, and then through the door marked "Storeroom."

Explain the following points to the class:

- The Storeroom contains 16 puzzle pieces. Gertrude chooses some of these puzzle pieces to bring to the puzzle rooms.
- Puzzle pieces have four shapes: diamond, hexagon, square, and triangle.
- The puzzle pieces have four colors: orange, green, blue, and purple.
- No two puzzle pieces are the same.

Gertrude's Puzzle Pieces and the Storeroom

Playing the Game Ask a student to pick up Gertrude, move her to the first "Loop Puzzle" (Room 4), and release her there.

Explain the following points to the class:

- When Gertrude is let down in a puzzle room, she flies away.
- She returns with a set of playing pieces that are used to solve the puzzle. Then she disappears.
- Students can find Gertrude resting in her nest in her room.

Then choose one student to retrieve Gertrude from her nest and release her in one of the puzzle rooms. After she flies in with the puzzle pieces, have the student return to the Storeroom. The pieces in the puzzle room are missing from the Storeroom.

Students can take turns at the computer releasing Gertrude in puzzle rooms and checking the Storeroom for missing puzzle pieces. The rest of the class can be involved in the off-line activities.

Off-Line Activities

GERTRUDE'S PUZZLE PIECES This activity can be used as an off-line activity during the classroom presentation, or when students take their individual turns exploring Gertrude's puzzle rooms on the computer. Students use this sheet to record the number of playing pieces Gertrude brings to each room, their colors, and their shapes. Recording this information gives students practice in identifying shape and color attributes, and prepares them for recognizing similarities and differences between the playing pieces. These skills are needed to solve the puzzles in GERTRUDE'S SECRETS.

You need:

- One activity sheet (page 4) for each student.
- Pencils, colored pencils, or crayons.

Distribute the sheet to the class. Be sure they understand the directions.

Gertrude's Puzzle Pieces		NAME _____			
Complete the Table					
Answer the questions below about the number and kind of playing pieces Gertrude brings into each puzzle room.					
Gertrude's Puzzle Pieces	How many pieces are there?	How many different colors are there?	What are the colors?	How many different shapes are there?	What are the shapes?
One-Loop Puzzle (Room 4)					
Two-Loop Puzzle (Room 5)					

If your students are not yet able to spell colors or the names of the shapes, have them indicate the colors by using crayons or colored pencils, and have them indicate shapes by drawing them.

GERTRUDE'S PLAYING PIECES In this activity, students prepare Attribute Cards that duplicate the shapes and colors of Gertrude's primary playing pieces. The four geometric shapes (triangle, diamond, square, and hexagon) are reproduced on the student handout. When the shapes are colored and cut out, students can use them in many of the off-line activities suggested later for each puzzle.

By preparing the Attribute Cards, students become more familiar with the shapes and colors of the 16 playing pieces in Gertrude's primary set.

You need:

- One activity sheet (page 5) for each student.
- Crayons or colored pencils in orange, blue, green, and purple.
- Cardboard or posterboard.
- Paste or glue.
- Clear contact paper.
- Scissors for each student or pair of students.
- Envelopes for storing the cards.

Gertrude's Playing Pieces		NAME _____		
Attribute Cards				
Color each shape. Cut out the cards.				
	Orange	Green	Blue	Purple
Diamond				
Hexagon				

Distribute the sheet and all the materials to the class. Be sure they understand the directions.

Have students color all 16 shapes according to the instructions on the activity sheet. Check each student's work before going further.

Ask student to paste the sheet on the cardboard or posterboard, cover it with the clear contact paper, and cut out the cards along the straight lines. If the cardboard you are using is fairly heavy, you may want to pre-cut it yourself to fit the size of the cards. Then students can paste their shapes onto the cardboard and cover them individually with the clear contact paper.

Gertrude's Puzzle Pieces and the Storeroom

Have students write their names on the front of the envelopes and put their Attribute Cards inside for safe-keeping. Tell them that they will be using these cards to solve Gertrude's puzzles and to play some games.

MATCH ME This game increases students' familiarity with the primary playing pieces in Gertrude's set, and gives them practice in recognizing similarities and differences between the 16 pieces.

You need:

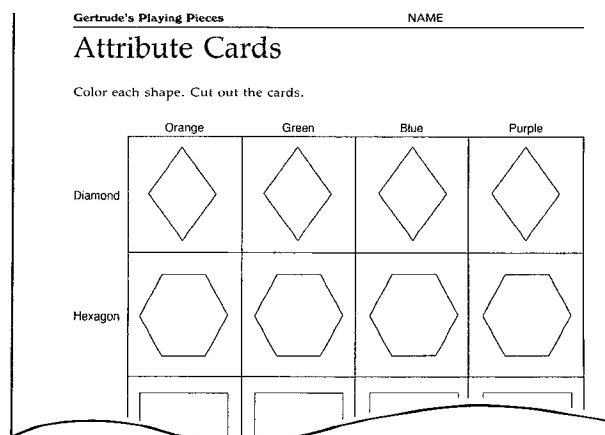
- One set of 16 Attribute Cards (page 5) for each pair of students.

To play:

- Divide the students into groups of two. Have them shuffle the cards and divide the deck into two piles of eight cards each, one pile for each player.
- Ask the first player to turn up the top card and lay it face up. Have the second player do the same.
- If the cards match in shape or color, the first player wins both cards and leads the next turn. If the cards don't match, have them placed in a discard pile and let the second player lead the next turn.
- When all the cards from both piles have been turned up, have one student shuffle the discard pile and divide it into two equal piles.
- Allow play to continue until all the cards have been won.

To win:

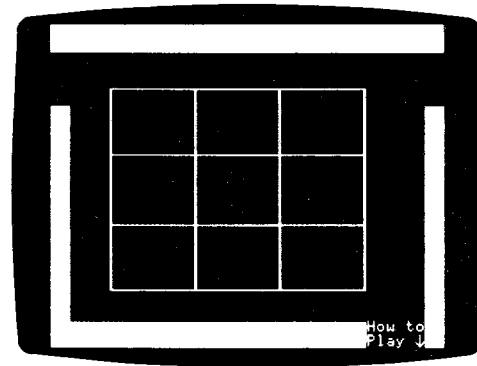
- The player with the most cards wins.



The Array Puzzles

Objectives

- Discriminating patterns of shapes and colors.
- Using arrays (preparation for grids).
- Following directions.
- Ordering.
- Deductively reasoning and problem-solving.
- Inferring patterns and rules.



In these two puzzles, students arrange playing pieces in a 3×3 array and a 4×4 array to fit Gertrude's secret pattern. While the pattern changes from game to game, the general rule stays the same: the playing pieces in each row and column must share a common attribute, either shape or color.

In both puzzles, clue pieces are given to help students determine the pattern. Misplaced playing pieces that do not fit the pattern fall out of the boxes in the array. Pieces that fit the pattern stay inside. These visual clues help students recognize similarities (rather than differences) between playing pieces in a row or column. They learn to recognize the pattern rules by simply observing the shape, color, and location of the clue pieces.

On-Line Presentation

If you have just loaded the program and the first room of GERTRUDE'S SECRETS appears, ask one student to pick up the flower, drop it inside the planter box, and move up to Gertrude's Room. If you are already in Gertrude's game world, simply move the cursor to Gertrude's Room. Here, have the student pick up Gertrude from her nest and move through the door marked "Arrays."

Begin by introducing the 3×3 array (Room 9 on the Map of Gertrude's World). The 4×4 array (Room 10) can be introduced in the same way after the class is familiar with the easier 3×3 array puzzle. Use the primary set of playing pieces (the geometric shapes) for your classroom presentation.

The Array Puzzles

Playing the Game In the puzzle room, ask the student to put Gertrude down. She will return with a set of playing pieces, and will put several of them in the puzzle.

Explain to the class that the puzzle is solved by picking up playing pieces and dropping them into the boxes to form a pattern. Each column and each row must have playing pieces that have the same shape or the same color. Make sure your students understand the concepts of *column* (vertical), *row* (horizontal), and *array* (an orderly arrangement of boxes or other objects). Then have students notice the clue pieces Gertrude put in the puzzle. You may want to name a rule that fits each piece in the column and row.

Before playing the game, have the student move the cursor through the door marked "How to Play." This room contains a completed sample puzzle. (The 4×4 array puzzle does not have a sample puzzle.) Point out to students the column and row rules that make up the pattern in this array. Here, the columns contain playing pieces with the same shape; the rows contain pieces with the same color.

Written instructions are in the room above each completed puzzle. Read the instructions aloud, and answer any questions students may have. Then ask the student to return to the puzzle room.

Solving the Array Puzzles Choose one student to solve the first puzzle by picking up playing pieces and dropping them into the boxes of the array.

Explain the following points to the class:

- The clue pieces determine the column and row rules for each game.
- Playing pieces in each column and row must have the same shape or the same color.
- Pieces that remain inside a box fit the pattern.
- Pieces that fall out of the box do not fit the pattern.
- When the puzzle is correctly solved, the walls of the puzzle room flash and Gertrude flies in with a treasure.

Encourage the whole class to participate by suggesting possible rules for each row and column, and the placement of the playing pieces.

When the puzzle is solved, ask students to describe the pattern in terms of the column and row rules. Give them the opportunity to state the rule for the placement of each piece.

A new game is started by picking up Gertrude and releasing her in the puzzle room. (If she is not next to her treasure, she will be resting in her nest.) The first puzzle pieces will disappear (to the Storeroom) and Gertrude will return with a new set. The treasure disappears to the Treasure Room.

You may want to have students solve one or two more puzzles during the classroom presentation before letting them play on their own. Once your class is familiar with the 3×3 array puzzle, introduce the more difficult 4×4 array puzzle.

Explain that this puzzle is solved in the same way as the 3×3 array puzzle, but that here they work with 16 pieces to form a pattern, not 9. As before, each column and row must contain pieces with the same shape or the same color.

Then follow the same format to solve the 4×4 array puzzle that you used to solve the 3×3 array puzzle.

You may vary the classroom presentations of these two puzzles by distributing the 3×3 Array Puzzle Board and the 4×4 Array Puzzle Board. While one student solves the puzzle at the computer, the rest of the class can choose the same set of playing pieces from their deck of Attribute Cards and solve the puzzle on their game boards.

After each classroom presentation, students can take turns at the computer solving puzzles individually or in pairs. The rest of the class can be involved in the off-line activities.

Off-Line Activities

3×3 ARRAY PUZZLE This game board can be used with your classroom presentation of the array puzzles in GERTRUDE'S SECRETS. While one student solves an array puzzle on the computer, the rest of the class can solve the same puzzle on their game boards using the Attribute Cards.

The Array Puzzles

You need:

- One activity sheet (page 6) for each student.
- One set of 16 Attribute Cards for each student.

To play:

- Choose one student to solve the puzzle on the computer using Gertrude's primary set of playing pieces.
- When Gertrude brings the playing pieces to the puzzle room, have the class choose the same pieces from their deck of Attribute Cards. Have them place in the puzzle the same three pieces that Gertrude does.
- Students continue placing their Attribute Cards on the game boards as the pattern is completed on the computer.

3 × 3 Array Puzzle NAME _____

Game Board

Use this game board to solve 3 × 3 array puzzles.

SPECIAL SOLUTIONS FOR THE 3 × 3 ARRAYS This game board can be used to extend your classroom presentation of the Array Puzzles in GERTRUDE'S SECRETS.

You need:

- One activity sheet (page 7) for each student.
- One set of 16 Attribute Cards for each student.
- Pencils and crayons.

To play:

- Have the students record several solutions to a puzzle using the same set of playing pieces each time.
- Students record their solutions to a puzzle by drawing and coloring the shapes in the boxes where they belong.

Special Solutions for the 3 × 3 Arrays NAME _____

Game Boards

Record the solutions by drawing and coloring the shapes.

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To vary this activity somewhat, have students place only two of Gertrude's playing pieces instead of three in the puzzle before beginning. They will discover that several solutions are possible.

Have students solve the Array puzzles using the Hat Cards. The shape and background pattern of the hats determine the row and column patterns.

Also, have students solve the Array puzzles using the Alphabet Cards. First have students agree on two attributes to use with these cards. For example, the pattern around the letters could be one attribute, and the number of straight and curved lines in the letters could be the other. In this case, the rows could contain letters with two straight lines (Y, V, and L), three straight lines (A, F, and H), and only curved lines (C, O, and S). Using these particular letters, the columns would contain letters with dotted, wavy, and plaid patterns. Help students select other appropriate sets of cards to solve the puzzle.

4 × 4 ARRAY PUZZLE This game board can be used with your classroom presentation of the Array Puzzles in GERTRUDE'S SECRETS.

You need:

- One Activity Sheet (page 8) for each student.
- One set of 16 Attribute cards for each student.

To play:

- Choose one student to solve the puzzle on the computer using Gertrude's primary set of playing pieces.
- When Gertrude brings the playing pieces to the puzzle room, have the class choose the same pieces from their deck of Attribute Cards. Have them place in the puzzle the same five pieces that Gertrude does.
- Students continue placing their Attribute Cards on the game boards until the pattern is completed.

4 × 4 Array Puzzle NAME _____

Game Board

Use this game board to solve 4 × 4 array puzzles.

The Array Puzzles

SPECIAL SOLUTIONS FOR THE 4×4 ARRAY This game board can be used to extend your classroom presentation of the Array Puzzles in GERTRUDE'S SECRETS.

You need:

- One activity sheet (page 9) for each student.
- One set of 16 Attribute Cards for each student.
- Pencils and crayons.

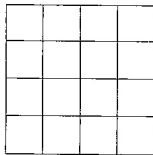
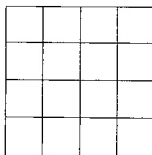
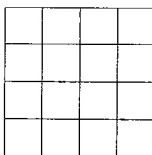
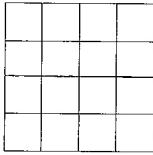
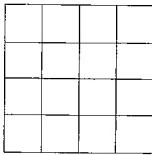
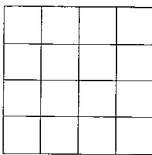
To play:

- Have the students record several solutions to a puzzle using the same set of playing pieces each time.
- Students record their solutions to a puzzle by drawing and coloring the shapes in the boxes where they belong.

Special Solutions for the 4×4 Arrays NAME _____

Game Boards

Record the solutions on one of the arrays below by drawing and coloring the shapes.

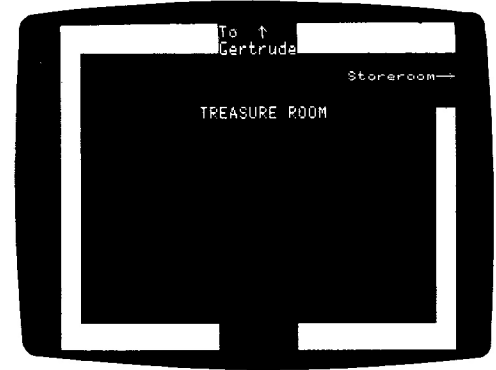
		
		

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The Treasure Room

Objectives

- Becoming familiar with the layout of the rooms.
- Practicing moving objects.
- Reinforcing understanding of attributes of primary playing pieces.



This classroom presentation can be initiated any time there is at least one treasure stored in the Treasure Room. Since a treasure is stored here for every correctly-solved puzzle, the number accumulates quickly.

On-Line Presentation

Wherever you are in Gertrude's game world, have one student move the cursor down to the Treasure Room. If you have just loaded the program, have one or two students correctly solve a puzzle so that a treasure will appear in the Treasure Room.

Explain to the class that for every correctly solved puzzle, Gertrude rewards them with a prize. These prizes, or treasures, are stored in the Treasure Room.

When your class has had a chance to view all the collected treasures, choose one student to begin the first game.

Playing the Game Position the class so that it cannot see the computer screen. Have the chosen student pick up a treasure and hide it behind a playing piece in the Storeroom.

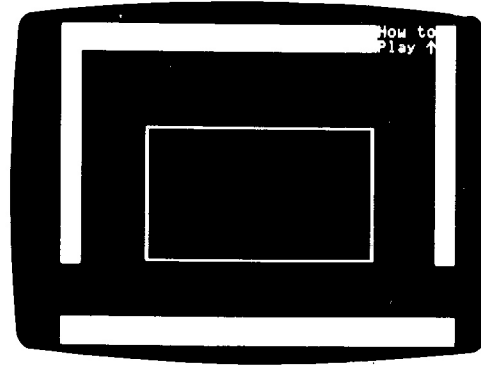
Now ask everyone to open their eyes and view the Storeroom on the screen. Have them take turns guessing the playing piece that hides the treasure. They must state both attributes of the playing piece: its shape and its color.

The first student to guess the hiding place may pick up the treasure and hide it, or another treasure, behind another playing piece.

The Loop Puzzles

Objectives

- Discriminating shapes and colors.
- Solving a loop (Venn diagram) puzzle.
- Following directions.
- Categorizing and inferring patterns and rules.
- Reasoning deductively.



The two loop puzzles in GERTRUDE'S SECRETS are Venn diagrams at two levels of difficulty: a one-loop puzzle and a two-loop puzzle. Students solve the puzzles by moving playing pieces inside the loops and inferring rules about which pieces belong inside. Playing pieces that do not fit Gertrude's secret rules will float out of the loops; those that fit the rules will stay inside.

Students use deductive reasoning to determine the rules that apply to each loop by interpreting what happens on the screen. One loop may only accept playing pieces with a particular shape or color, such as triangles or blue pieces. Another loop may only accept pieces with a particular shape *and* color, such as blue triangles.

By observing which playing pieces remain in the loops and which ones float out, students are able to determine the rules and solve the puzzles with minimal clues.

In the two-loop puzzle, the two overlapping loops form a third loop. Students learn that the rule for this third loop shares a common characteristic with the rules for the other two loops. For example, if the rule for one loop is square pieces and the rule for the second loop is purple pieces, the rule for the third loop will be purple squares. Students discover that the overlapping regions often remain empty. This occurs when the rules for both loops limit only the shape or only the color of the playing pieces.

Students learn that a good strategy in solving the two-loop puzzle is to drop the playing pieces in the overlapping region of the loops first. By dropping the playing pieces in the overlapping regions first, they will be testing all three regions at once.

On-Line Presentation

If you have just loaded the program and the first room of GERTRUDE'S SECRETS appears, ask one student to pick up the flower, drop it inside the planter box, and move up to Gertrude's Room. If you are already in Gertrude's game world, simply move the cursor to Gertrude's Room. Here, have the student pick up Gertrude from her nest, and move through the door marked LOOPS.

Begin by introducing the one-loop puzzle. The two-loop puzzle (Room 5) can be introduced in the same way after the class is familiar with the easier one-loop puzzle.

Playing the Game In the puzzle room, ask the student to release Gertrude. She will return with a set of playing pieces.

Explain to the class that the puzzle is solved by picking up playing pieces and dropping them into the "boxes" formed by the loops. Gertrude has a secret rule for the puzzle. One rule might be "only squares," or "only blue pieces." A more restrictive rule might be "only purple squares" or "only green hexagons." Gertrude will give them clues to help them discover the rule.

Before playing the game, have the student move the cursor through the door marked "How to Play." This room contains a completed sample puzzle that illustrates one or more of Gertrude's secret rules. In the one-loop sample puzzle, point out that the rule pertains to shape (diamonds). In the two-loop sample puzzle, one rule pertains to shape (squares), one to color (blue), and one to both (blue squares). Make sure students understand that the pieces in the overlapping box in the two-loop puzzle share a common characteristic with the pieces in the other boxes. In the completed sample puzzle, these pieces share the shape of the pieces in one box (square) and the color of the pieces in the other box (blue).

Written instructions are in the room above each completed puzzle. Read the instructions aloud, and answer any questions students may have. Then ask the student to return to the puzzle room.

Solving the Loop Puzzles Choose one student to solve the first puzzle by picking up playing pieces and dropping them into the box or boxes.

The Loop Puzzles

Explain the following points to the class:

- Pieces that remain inside a box fit the rule.
- Pieces that float out of a box do not fit the rule.
- Each box has a different rule and the overlapping box shares a common rule with the boxes that form it.
- When the puzzle is correctly solved, the walls of the puzzle room flash and Gertrude flies in with a treasure.

Encourage the whole class to participate by guessing which pieces go where and by suggesting possible rules for each box. When the puzzle is solved, have students state the rule or rules for solving the puzzle. A new game is started by picking up Gertrude and releasing her in the puzzle room. The first puzzle pieces disappear to the Storeroom and Gertrude returns with a new set of puzzle pieces. The treasure disappears to the Treasure Room.

Once your class is familiar with the one-loop puzzle and can solve it with minimum difficulty, introduce the more complex two-loop puzzle. Explain to the class that the two loops overlap to form three boxes, and each box has a different rule.

Then follow the same format to solve the two-loop puzzle that you used to solve the one-loop puzzle.

After each classroom presentation, students can take turns at the computer solving puzzles individually or in pairs. The rest of the class can be involved in the off-line activities.

Off-Line Activities

ONE-LOOP PUZZLE The Loop Puzzle Games simulate on paper the same loop puzzles solved on the computer in GERTRUDE'S SECRETS. Students use their sets of Attribute Cards to solve the puzzles. One student records on a separate activity sheet the secret rule for solving the puzzle. Then another student guesses the secret rule by placing Attribute Cards on the game board.

Loop Puzzle Games are somewhat more difficult to solve than those in GERTRUDE'S SECRETS because students use all 16 playing pieces in Gertrude's set. In the computer program, the 16 pieces never appear at the same time in a loop-puzzle room.

You need:

- Two activity sheets (pages 10 and 11) for each pair of students.
- One set of 16 Attribute Cards for each pair of students.

To play:

- Divide the class into groups of two. Ask one student from each pair to be the player and the other to be the solution-keeper.
- Have the solution-keeper think of a secret rule for solving the puzzle, and record the solution on the Secret Solutions activity sheet by drawing in the shape and color where they belong. (The solution must be kept hidden from the player and should be checked.)
- Have the player guess the secret rule by placing Attribute Cards, one at a time, in the box on the game board. When the solution-keeper answers a guess with "Yes, it fits," the player leaves the Attribute Card on the game board. If the answer is "No," the player removes the Attribute Card.
- Allow play to continue until the player guesses the rule and solves the puzzle.

To win:

- The player needs to guess the rule to solve the puzzle.

To vary this activity, you may want students to keep track of the number of guesses needed to solve each puzzle. This discourages students from continued random guessing.

Students may be encouraged to make up new rules that are not used in GERTRUDE'S SECRETS. For example, one rule might be only shapes with an even number of sides (squares, diamonds, hexagons) or an odd number of sides (triangles). But make sure all students are aware of the new rules before a "solution-keeper" uses them as part of a secret solution.

One-Loop Puzzle
NAME _____

Game Board

One-Loop Puzzle
NAME _____

Secret Solutions

Make up a rule for solving a one-loop puzzle for each box. Draw the different shapes and colors in the box where they belong.

1.

2.

3.

4.

The Loop Puzzles

TWO-LOOP PUZZLE This puzzle extends the work with Venn diagrams to a higher level of difficulty. Remind the students that the intersecting region of the puzzle may remain empty.

You need:

- Two activity sheets (pages 12 and 13) for each pair of students.
- One set of 16 Attribute Cards for each pair of students.

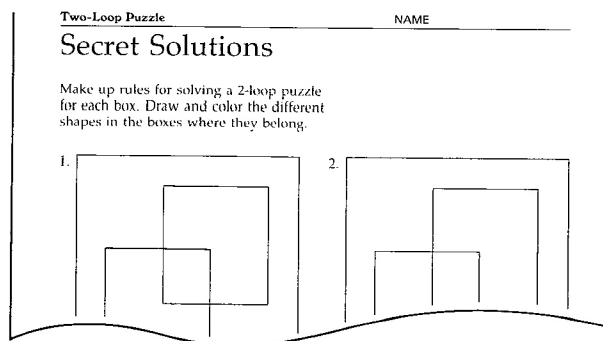
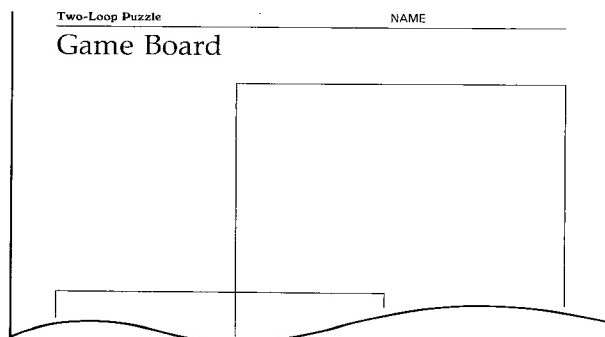
To play:

- Divide the class into groups of two.
- Ask one student from each pair to be the “player” and the other to be the “solution-keeper.”
- Have the solution-keeper think of a secret rule for solving the puzzle. Have him or her record the solution on the Secret Solutions activity sheet by drawing in the shapes and colors where they belong. (The solution must be kept hidden from the player and should be checked by you before proceeding.)
- Have the player guess the secret rule by placing Attribute Cards, one at a time, in the boxes on the game board. When the solution-keeper answers a guess with “Yes, it fits,” the player leaves the card on the game board. If the answer is “No, it doesn’t fit,” the player removes the card.
- Allow play to continue until the player guesses the rule and solves the puzzle. Then have the students trade roles and play again.

To win:

- The player needs to guess the rule to solve the puzzle.

In the two-loop puzzle, help students understand why the overlapping region sometimes remains empty. If both rules for the two loops limit only the color, the overlapping region is empty because no card has two colors.



LOGICAL ADDITION In this guided demonstration, students explore the difference between logical addition and numerical addition in a two-loop puzzle. Under logical addition, $4 + 4$ can equal 7; numerical addition always gives $4 + 4 = 8$.

You need:

- One activity sheet (page 12) for each student.
- One set of 16 Attribute Cards for each student.

Ask students to collect all the triangles and all the orange shapes from their Attribute Cards. Have them solve the puzzle by placing their cards in the loops on the game board according to this rule: Orange shapes belong in the loop on the right, and triangles belong in the loop on the left. When students have correctly solved the puzzle, ask them the following questions: "How many orange shapes are there? (4)" "How many triangles are there? (4)" "How many orange shapes and triangles are there all together? (7)"

Help students understand that the orange triangle is counted twice, once as a triangle and once as an orange shape. That is why when the shapes in each loop are counted, there are eight, but when the pieces themselves are counted, there are only seven. This is an example of *logical addition*. Choose another set of playing pieces, such as hexagons and purple shapes, and repeat the activity.

Next, ask students to collect all the triangles and all the squares from their Attribute Cards. Have them solve the puzzle by placing their Attribute Cards in the loops on their game boards according to this rule: Squares belong in the loop on the right, and triangles belong in the loop on the left.

When students have correctly solved the puzzle, ask them the following questions: "How many squares are there? (4)" "How many triangles are there? (4)" "How many squares and triangles are there all together? (8)"

Help students understand that because no piece is in the overlapping region of the loops, no piece is counted twice. The shapes are mutually exclusive (there is no such thing as a square triangle or a triangular square). This is an example of *logical addition* working like *numerical addition*. Choose another set of playing pieces, such as blue and green shapes, and repeat the activity.

The Loop Puzzles

THE CASTLE GAME In this stimulating game of pretend, students apply the principles of solving loop puzzles to a new context. Here, two students act as "castle guards" and admit students into an imaginary castle according to a secret rule. By observing which students are admitted and which are not, two castle "spies" try to guess the castle guards' secret rule. Students learn to translate the shape and color attributes in the loop puzzles into new attributes that describe their classmates, such as articles of clothing, letters in a name, or seating location in the classroom. Solving the secret castle rule encourages students to think creatively and adapt their problem-solving skills to new situations.

You need:

- Chalk or several yards of string.
- Scissors.

To play:

- Mark a large circle on the floor with chalk or string to represent the castle. Choose two students to be the castle guards and two students to be the spies from another kingdom.
- Ask the castle guards to make up a rule about who may enter the castle and who may not.
- Have the other students approach the castle one at a time. The guards may say, "You may enter the castle" or "You may not enter the castle" according to the secret rule. Students either enter the circle or remain outside of it.
- Allow play to continue until one of the spies (or anyone in the class) guesses the secret rule.

To win:

- A player needs to guess the secret rule.

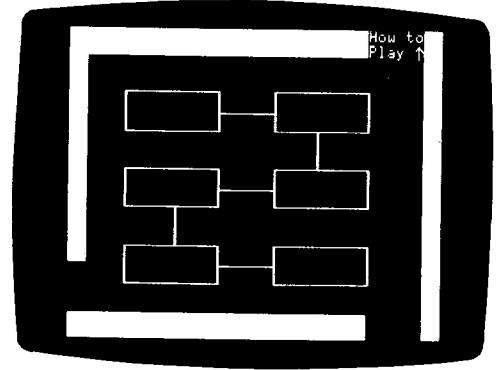
You may want to suggest secret rules that can be used to admit students to the castle, such as only students wearing jeans, sitting in the last row, wearing a watch, or having brown hair. Ask students to avoid using rules that may be subjective such as only students with "long hair" or who are "tall." The rules need to be unambiguous so that everyone will agree on them.

To vary this game somewhat, play it with two "castles," that is, two circles that overlap like the two-loop puzzle. Students admitted to the overlapping area will share a common attribute with students admitted to the two large circles.

The Train Puzzles

Objectives

- Discriminating similarities and differences.
- Following directions.
- Recognizing relationships between objects.
- Sequencing.
- Deductively reasoning and problem-solving.
- Discovering multiple solutions.



In these puzzles, students arrange playing pieces in boxes according to “difference” rules. Boxes connected by single lines must contain playing pieces that differ in only one way (either shape or color). Boxes connected by double lines must contain playing pieces that differ in two ways (both shape *and* color). All three puzzles begin with a given playing piece in the first box. Subsequent pieces must fit the rule indicated by the single or double lines.

The three train puzzles are carefully sequenced according to difficulty so that students learn the difference rules one at a time. To solve these puzzles, students must be able to discriminate shapes and colors. Once students recognize the relationships between playing pieces, they can begin categorizing and analyzing patterns that fit the difference rules of the train.

On-Line Presentation

If you have just loaded the program and the first room of GERTRUDE'S SECRETS appears, ask one student to pick up the flower, drop it inside the planter box, and move up to Gertrude's Room. If you are already in Gertrude's game world, simply move the cursor to Gertrude's Room. Here, have the student pick up Gertrude from her nest and move through the door marked “Trains.”

Begin by introducing the first 6-box train puzzle (Room 6 on the Map of Gertrude's World). The other 6-box train puzzle (Room 7) and the 9-box train puzzle (Room 8) can be introduced in the same way after the class is familiar with the easier 6-box train puzzle. Use the primary set of playing pieces (the geometric shapes) for your classroom presentation.

The Train Puzzles

Playing the Game In the puzzle room, ask the student to release Gertrude. She will return with a set of playing pieces, and will put one in the first box.

Explain to the class that the puzzle is solved by picking up playing pieces and dropping them into the boxes of the train, one at a time, according to "difference" rules. In the first puzzle, the boxes are connected by single lines, and each box must contain a playing piece that differs in only one way (either shape or color) from the piece before it. In the second puzzle, the boxes are connected by double lines, and each box must contain a playing piece that differs in two ways (both shape and color) from the piece before it. In the third puzzle, the boxes are connected by either single or double lines so students must apply both difference rules to solve the puzzle. Ask students to identify the number of different shapes and colors in the set of playing pieces Gertrude brought. This will help prepare them for using the difference rules to solve the puzzles.

Before playing the game, have the student move the cursor through the door marked HOW TO PLAY. If you are introducing one of the 6-box puzzles, this room contains a completed sample puzzle. (The 9-box puzzle does not have a sample puzzle.) Point out to students how each playing piece in the sample puzzle conforms to either the "one-difference" rule or the "two-difference" rule.

Now move up to the next room, read the instructions aloud, and answer any questions students may have. Then ask the student to return to the puzzle room.

Solving the Train Puzzles Choose one student to solve the first puzzle by picking up playing pieces and dropping them into the boxes.

Explain the following points to the class:

- Playing pieces that have a different shape *or* color from the pieces before them belong in boxes connected by single lines.
- Playing pieces that have a different shape *and* color from the pieces before them belong in boxes connected by double lines.
- Pieces that remain inside a box in the 6-box puzzles fit the rule; pieces that fall out of a box in the 6-box puzzles do not fit the rule.
- When the puzzle is correctly solved, the walls of the puzzle room flash and Gertrude flies in with a treasure.

Encourage the whole class to participate by suggesting playing pieces that fit the rule for each consecutive box. When the puzzle is solved, have students study the final locations of the playing pieces and articulate the rule for the placement of each piece.

A new game is started by picking up Gertrude and releasing her in the puzzle room. (If she is not next to her treasure, she will be resting in her nest.) The first puzzle pieces will disappear (to the Storeroom) and Gertrude will return with a new set. The treasure disappears to the Treasure Room.

You may want to have students solve one or two more puzzles during the classroom presentation before letting them play.

Once your class is familiar with the first 6-box puzzle that uses the one-difference rule, introduce the other 6-box puzzle that uses the two-difference rule. This puzzle can be introduced in the same way.

When students can solve the two 6-box puzzles with minimum difficulty, introduce the more complex 9-box puzzle that uses both difference rules.

Explain to the class that there is more than one correct solution to this puzzle, and that misplaced pieces will fall out of the boxes.

After each classroom presentation, students can take turns at the computer solving puzzles individually or in pairs. When they have mastered all the puzzles, have them visit the "New Puzzle Piece Room" or the "Shape-Edit Room" to introduce new playing pieces to all the games. Meanwhile, the rest of the class can be involved in the off-line activities.

Off-Line Activities

ONE-DIFFERENCE TRAIN PUZZLE Each of the three Train Puzzle Game Boards (One-Difference, Two-Difference, and Mixed-Difference) can be used with your classroom presentation of each train puzzle in GERTRUDE'S SECRETS. While one student solves a train puzzle on the computer, the rest of the class can solve the same puzzle on their game boards using the Attribute Cards.

The Train Puzzles

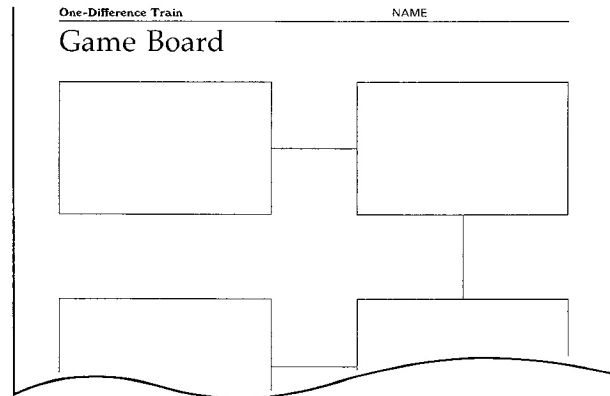
You need:

- One activity sheet (page 14) for each student.
- One set of 16 Attribute Cards for each student.

To play:

- Choose one student to solve the train puzzle on the computer using Gertrude's primary set of playing pieces.
- When Gertrude brings the playing pieces to the puzzle room, have the class choose the same pieces from their deck of Attribute Cards. Have them place in the first rectangle the same piece that Gertrude does.
- Students continue placing their Attribute Cards on the game boards according to the difference rules until the puzzle is solved.
- The class will discover that different solutions are possible.

To vary this activity somewhat, divide the class into teams of two, three, or four students. Have each team place a different playing piece in the second rectangle of the puzzle and still follow the one-difference rule. Each team will find a different solution to the puzzle.

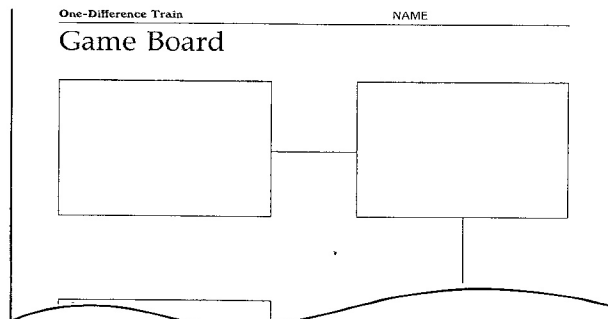


SPECIAL SOLUTIONS FOR ONE-DIFFERENCE TRAINS

Other solutions to the one-difference train puzzle can be recorded using this activity.

You need:

- Two activity sheets (pages 14 and 15) for each student.
- One set of 16 Attribute Cards for each student.
- Pencils and Crayons.



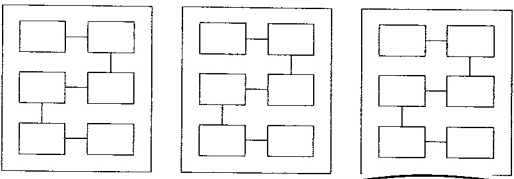
To play:

- Have students record several solutions to a puzzle, using the same set of playing pieces each time.
- Students record their solutions to a puzzle by drawing and coloring the shapes in the rectangles where they belong.

Special Solutions for One-Difference Trains
NAME _____

Game Boards

You can find many different solutions to one puzzle. Record the solutions by drawing and coloring the shapes.



TWO-DIFFERENCE TRAIN PUZZLE This puzzle extends the ideas examined in the one-difference train.

You need:

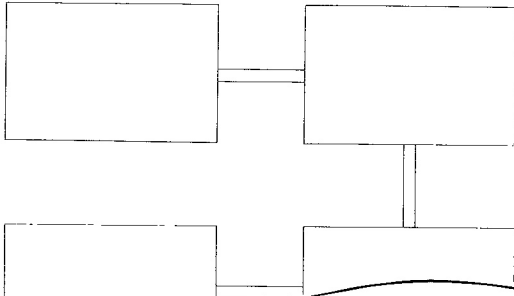
- One activity sheet (page 16) for each student.
- One set of 16 Attribute Cards for each student.

To play:

- Choose one student to solve the train puzzle on the computer using Gertrude's primary set of playing pieces.
- When Gertrude brings the playing pieces to the puzzle room, have the class choose the same pieces from their deck of Attribute Cards. Have them place in the first rectangle the same piece that Gertrude does.
- Students continue placing their Attribute Cards on the game boards according to the difference rules until the puzzle is solved.
- The class will discover that different solutions are possible.

Two-Difference Train Puzzle
NAME _____

Game Board



To win:

- The student needs to solve the puzzle correctly.

To vary this activity somewhat, have students solve the train puzzles using the Alphabet Cards or the Hat Cards.

The Train Puzzles

SPECIAL SOLUTIONS FOR TWO-DIFFERENCE TRAINS

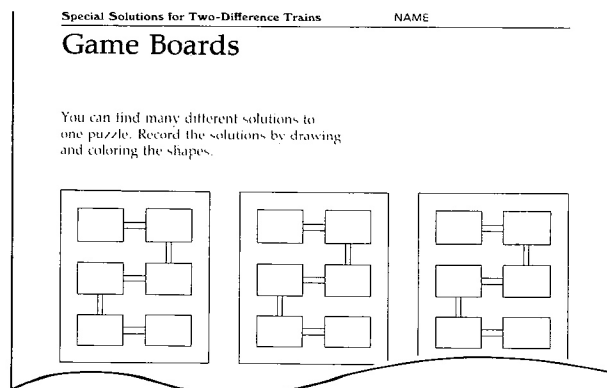
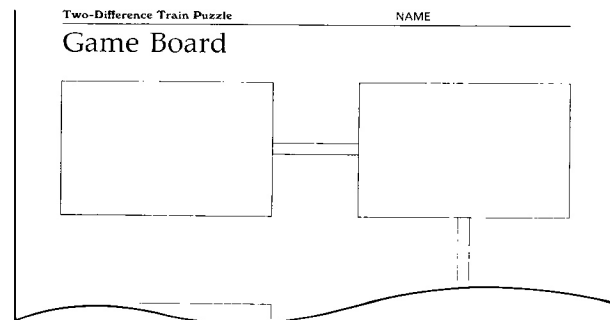
Additional solutions to the two-difference train can be produced and recorded in this activity.

You need:

- Two activity sheets (pages 16 and 17) for each student.
- One set of 16 Attribute Cards for each student.
- Pencils and Crayons.

To play:

- Have students record several solutions to a puzzle using the same set of playing pieces each time.
- Students record their solutions to a puzzle by drawing and coloring the shapes in the rectangles where they belong.



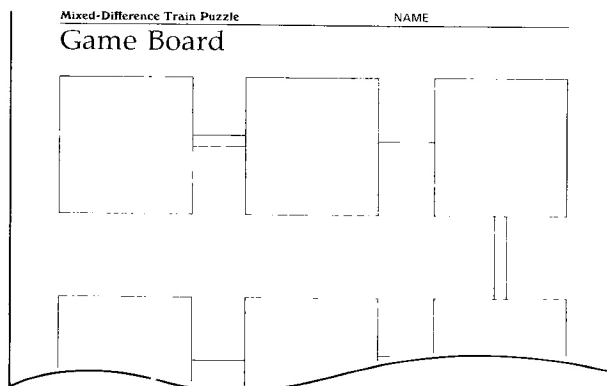
MIXED-DIFFERENCE TRAIN PUZZLE This train puzzle generalizes the concepts involved in the simpler trains. Here adjoining "cars" differ by either one or two characteristics.

You need:

- One activity sheet (page 18) for each student.
- One set of 16 Attribute Cards for each student.

To play:

- Choose one student to solve the train puzzle on the computer, using Gertrude's primary set of playing pieces.



- When Gertrude brings the playing pieces to the puzzle room, have the class choose the same pieces from their deck of Attribute Cards. Have them place in the first rectangle the same piece that Gertrude does.
- Students continue placing their Attribute Cards on the game boards according to the difference rules until the puzzle is solved.
- The class will discover that different solutions are possible.

SPECIAL SOLUTIONS FOR MIXED-DIFFERENCE TRAINS

Other solutions to the mixed-difference train puzzle can be recorded using this activity.

You need:

- Two activity sheets (pages 18 and 19) for each student.
- One set of 16 Attribute Cards for each student.
- Pencils and crayons.

To play:

- Have students record several solutions to a puzzle using the same set of playing pieces each time.
- Students record their solutions to a puzzle by drawing and coloring the shapes in the rectangles where they belong.

Mixed-Difference Train Puzzle NAME _____

Game Board

Special Solutions for Mixed-Difference Trains NAME _____

Game Boards

You can find many different solutions to one puzzle. Record the solution on one of the trains below by drawing and coloring the shapes.

The Train Puzzles

THE TRAIN GAME This two-player game reinforces students' skill in solving the Mixed-Difference Train Puzzle in GERTRUDE'S SECRETS. The game can be played using the Attribute Cards, the Hat Cards, or the Alphabet Cards. The game has students place cards end-to-end according to a one-difference or two-difference rule determined by a flip of a coin.

You need:

- One set of 16 Attribute Cards.
- One set of 16 Hat Cards (optional).
- One set of 26 Alphabet Cards (optional).
- One coin for each pair of students.

To play:

- Divide the class into groups of two.
- Have the groups shuffle their cards and deal the same number of cards to each player.
- Have the first player put down any card to start the train.
- Ask the next player to toss the coin. If the coin lands *heads up*, the player puts down a card that differs in *one* way from the first card. If the coin lands *heads down*, the player puts down a card that differs in *two* ways. If the player does not have a card that fits the rule, he or she forfeits a turn. Cards can be placed end-to-end or side-by-side to make the train.
- Have players take turns tossing the coin and putting down cards.

To win:

- The first player to put down all of the cards wins.

New Puzzle Piece Room

Objectives

- Extending recognition of shape and color.
- Understanding the concept of sets.
- Developing a vocabulary to describe shapes.



In the New Puzzle Piece Room, students discover how to transform the original set of primary playing pieces into totally new sets. They do this by picking up one of the six shapes in the room, each representing a whole new set of shapes, and dropping it in the Storeroom. The shapes of all 16 primary playing pieces are dramatically transformed.

Through this demonstration of computer magic, students have an opportunity to extend their recognition of shape and color. Once they understand and recognize the similarities and differences between the colored geometric shapes in the original set, their awareness of these concepts can be expanded by working with new sets. Students will develop a vocabulary to describe the new shapes of the playing pieces in order to distinguish them from each other. Labels like "triangle" and "diamond" will no longer apply.

In addition, the transformation of the playing pieces enhances students' enjoyment of solving the puzzles, since each puzzle takes on a new dimension.

On-Line Presentation

If you have just loaded the program and the first room of GERTRUDE'S SECRETS appears, ask one student to pick up the flower, drop it inside the planter box, and move up through the Treasure Room and into the Storeroom. If you are already in Gertrude's game world, simply move the cursor to the Storeroom.

To maximize the dramatic effect of the presentation, all 16 primary playing pieces should be in the Storeroom. If they are, ask the stu-

New Puzzle Piece Room

dent to move the cursor through the door marked NEW PIECES ROOM. If pieces are missing, have the student find Gertrude, carry her into the Storeroom, and release her there. Then move to the New Puzzle Piece room.

Read the instructions aloud. Explain to students that each of the six shapes represents a whole new set of playing pieces. Have students identify the six different shapes before transforming the original set of playing pieces.

Playing the Game Choose one student to transform the playing pieces by picking up one of the shapes in the New Puzzle Piece Room, moving it to the Storeroom, and dropping it.

Explain the following points to the class:

- Each shape in the New Puzzle Piece Room stands for four new shapes in four colors. This is a 16-piece set.
- If some pieces are missing from the Storeroom when the set is transformed, those pieces (in one of the puzzle rooms) will also be transformed.

Have students take turns transforming the playing pieces into all six sets. Ask them to describe the differences between the shapes in each set to help prepare them for using the new pieces to solve puzzles. Once students have explored the new shapes, have them solve the puzzle they are most familiar with using the new playing pieces.

While students play individually or in pairs at the computer, the rest of the class can be involved in the off-line activities.

Off-Line Activities

MATCH MY HAT This two-player card game is played in the same way as the Match Me game. Here students use the Hat Cards. Like the transformed shapes from the New Puzzle Piece Room in GERTRUDE'S SECRETS, the Hat Cards suggest new rules for sorting and classifying objects.

Students generalize their ability to recognize similarities and differences between geometric shapes by describing the relationships between the hats in this set. Unlike the geometric shapes of the pri-

mary playing pieces, the hats in this set may be described as fancy, work-related, or undecorated. In the same way, students learn to recognize background patterns (dotted, wavy, striped, or plaid) as a new attribute in this set, replacing color in the primary set in GERTRUDE'S SECRETS.

You need:

- One set of 16 Hat Cards (page 20) for each pair of students.
- Scissors.

To play:

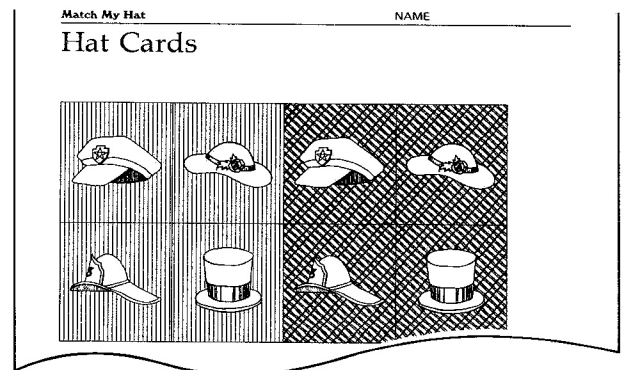
- Divide the class into groups of two.
- Have the groups shuffle the cards and divide the deck into two piles of eight cards each—one pile for each player.
- Ask the first player to turn up the top card and lay it face up.
- If the cards match in shape or pattern, the first player wins both cards and leads the next turn. If the cards don't match, have them placed in a discard pile and let the second player lead the next turn.
- When all cards from both piles have been turned up, have one student shuffle the discard pile and divide it into two equal piles.
- Allow play to continue until all cards have been won.

To win:

- The student who has the most cards wins.

To vary this activity somewhat, encourage students to make up new rules for matching the cards. For example, hats that indicate a job, such as the fire fighter's hat and the police officer's hat, could be a match. Another match could be hats worn to a party (the flowered hat and the top hat).

Also, students could color each kind of hat in four different colors and use color instead of pattern as a rule for matching. Make sure students use the same color for the four cards with the same background pattern.



New Puzzle Piece Room

MAKE A RULE! GUESS A RULE! This game uses the Hat Cards to give students an opportunity to create and discover rules based on the attributes of the 16-card set. The game increases students' awareness of the relationships between the shape and pattern attributes of the Hat Cards. It also prepares them for solving Gertrude's puzzles using pieces from the "New Puzzle Piece Room."

This game has one student arrange six or eight cards in a row according to a made-up rule. For example, cards with the same background pattern or the same shape may be placed side-by-side. Another student guesses the rule and completes the card arrangement with the remaining cards.

You need:

- One set of 16 Hat Cards for each pair of students (page 20.)

To play:

- Divide the class into groups of two.
- Have one student from each pair arrange six or eight Hat Cards in a row according to a secret rule. Ask the other student to guess the rule.
- When the rule is discovered, have the student complete the card arrangement with the remaining cards.
- Have students take turns making up rules and guessing them.

You may want to suggest rules for arranging the cards to get students started on their own. Here are two examples:

Rule: Group by hats and the four patterns alternate in the same order.

Rule: Group by patterns and the four kinds of hats are in the same order.

HAT IN THE LOOP This game is a variation of the Loop Puzzle Board Games. Here, students use the Hat Cards instead of the Attribute Cards with geometric shapes to solve both loop puzzles on the game boards. One student decides on a secret rule or rules to fit the new attributes of the Hat Cards. Another student guesses the secret

rule(s) by placing cards on the game board and receives positive and negative clues from the first student.

Using the set of Hat Cards instead of the primary playing pieces in Gertrude's set reinforces and extends students' ability to recognize similarities and differences between objects.

You need:

- Two activity sheets (pages 10 and 12) for each pair of students.
- One set of 16 Hat Cards (page 20) for each student.

To play:

- Divide the class into groups of two.
- Ask one student from each pair to be the player and the other to be the solution-keeper.
- Have the solution-keeper think of a secret rule for solving the puzzle. Have him or her secretly choose the card or cards from the deck that fits the made-up rule for solving the puzzle.
- Have the player guess the secret rule by placing Hat Cards from a complete deck, one at a time, in a box on the game board. When the solution-keeper answers a guess with "Yes, it fits," the player leaves the Hat Card on the game board. If the answer is "No, it doesn't fit," the player removes the Hat Card.
- Allow play to continue until the puzzle is solved. Then have the students trade roles and play again.

To win:

- The student needs to discover the rule.

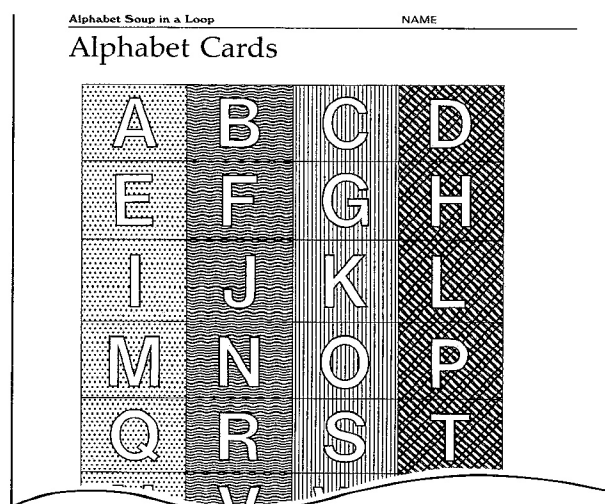
In the two-loop puzzle, help students understand why the overlapping region sometimes remains empty. If both rules for the two loops limit only pattern, the overlapping region is empty because no card has two patterns.

To vary this activity somewhat, you may want students to keep track of the number of guesses needed to solve each puzzle. (Gertrude does not do this in GERTRUDE'S SECRETS.) This discourages students from continued random guessing.

ALPHABET SOUP IN A LOOP In this game, students solve one-loop and two-loop puzzles using the 26-piece set of Alphabet Cards. Since the letters of the alphabet have many more attributes than the geometric shapes in Gertrude's primary set of playing pieces (or the transformed shapes from the "New Puzzle Piece Room"), students can sort and classify them in a wide variety of ways. They learn to recognize new attributes that determine similarities and differences between letter shapes, and use those attributes as rules in solving the puzzles.

You need:

- One set of 26 Alphabet Cards (page 21) for each pair of students.
- Two activity sheets (pages 10 and 12) for each pair of students.



Introduce some of the many attributes of the Alphabet Cards.

Attribute

Example

Pattern

A is dotted, B is wavy, C is striped, and D is plaid.

Hole

A, D, and P have holes.

No hole

E, T, and Z have no holes.

Vertical symmetry

U, M and W have vertical symmetry.

Horizontal symmetry

E, C, and X have horizontal symmetry.

Vertical and horizontal symmetry

O, I and H have both vertical and horizontal symmetry.

No symmetry

F, G, and R have no symmetry.

Curved lines

C, O, and Q have curved lines.

Straight lines

V, T, and L have straight lines.

Choose one attribute to serve as a rule for solving the one-loop puzzle. Choose two for solving the two-loop puzzle. Divide the class

into groups of two. Have students work together choosing from their deck cards that fit the rules. Have them place the cards inside the loop where they belong. Ask each pair of students to check their puzzle solutions with others around them.

To vary the activity somewhat, when students have completed a puzzle, ask them to spell as many words as they can from the letters inside the loops.

PEOPLE SETS This activity applies the principles used for solving the two-loop puzzles to a new set with different attributes.

You need:

- One activity sheet (page 22) for each student.
- Chalk and a chalkboard.
- Pencils.

Ask for the names of students who biked to class, had milk for breakfast, and who did neither. List their names on the board under the headings "Biked," "Milk," "Did Neither." Draw lines to connect the names that appear on both lists.

People Sets	NAME _____
<p style="text-align: center;">Attributes</p> <p>Use information from your class to answer these questions.</p> <ol style="list-style-type: none"> 1. How many students biked to school? _____ 2. How many students had milk for breakfast? _____ 3. How many students biked to school and had milk for breakfast? _____ 4. How many students biked to school and did not have milk for breakfast? _____ 5. How many students did not bike to school and had milk for breakfast? _____ 6. How many students did not bike to school and did not have milk for breakfast? _____ 7. Could you have answered these questions using only the information in the lists? _____ 	

Draw a two-loop puzzle on the chalkboard, making it as large as possible. Label one loop "Biked" and the other "Milk."

Ask individual students to come to the board one at a time and write their own name in the loops. Students who did both will discover that their names belong in the overlapping region of the loops. Students who did neither should write their names outside of the loops.

Ask students to compare the information in the loops with the information on the lists, and verify that the loops contain the correct information. Distribute the activity sheet and have students answer the questions.

You may wish to create more people sets using two other attributes, such as eye or hair color, number in the family, sports enthusiasts, music lovers or other attributes your students suggest.

ATTRIBUTES AND SETS During this guided discussion and activity, students discover that the attributes of the playing pieces in GERTRUDE'S SECRETS (Shape and color) are only two of a wide range of attributes that the set could have. They also explore ideas for new sets with attributes other than shape and color.

You need:

- 3×5 index cards, one for each student.
- Pencils.

To discuss *attributes*, ask the students for some new attributes that Gertrude's playing pieces could have in addition to color and shape. Discuss, for example, how each playing piece could be big or small. Ask how many pieces there would be in a set with this third attribute added (twice as many: 32 pieces). Ask how large the set would be if each piece came in three sizes: small, medium, and large (48).

To discuss *sets*, ask students to suggest ideas for new sets, and name some of the attributes the objects in the set might have. Use these examples to stimulate discussion.

Buttons: color, size, shape, number of holes

Playing cards: color, shape, number

Fruit: color, size, shape, texture (soft, hard, rough, smooth)

Animals: speed (swift or slow-moving), number of legs, body covering (feathers, fur, scales or hide), movement (runs, crawls, or flies)

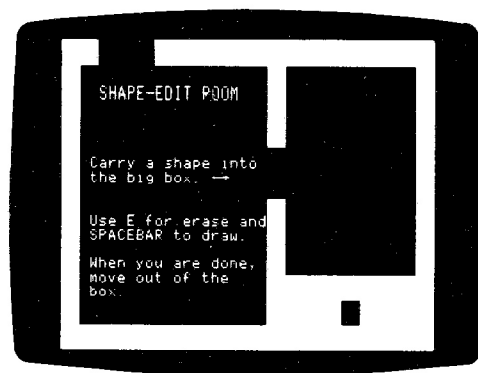
Words: length of words (2, 3, and 4 letters), vowels and consonants, initial letters, ending letters

Then, distribute the 3×5 cards and ask the students to write down their names and the kind of pet they have or wish they had. Collect the cards and lay them on a table. Ask students to suggest ways the cards could be sorted. For example, pets that live in or near water (fish, turtles, chameleons), or pets that run and play outside (dogs and cats).

The Shape-Edit Room

Objectives

- Changing and creating playing pieces.
- Using computer graphic techniques.
- Categorizing and defining shapes.



To create the new playing pieces, students use computer graphics techniques to add or delete parts of an existing playing piece. Pieces are created on a grid defined by rectangles the same size as the cursor. The piece is magnified in the "Shape-Edit Room" to allow students to see the modifications they are making.

When students use their own playing pieces to solve the puzzles, they categorize shapes and define relationships between the pieces in new ways. They learn to apply labels that describe the differences between their new playing pieces. Students can develop abstract thinking skills by working with increasingly complex puzzles.

On-Line Presentation

If you have just loaded the program and the first room of GERTRUDE'S SECRETS appears, ask one student to pick up the flower, drop it inside the planter box, and move up through the Treasure Room and into the Storeroom. If you are already in Gertrude's game world, simply move the cursor to the Storeroom.

To best demonstrate the capability of the Shape-Edit Room, all 16 primary playing pieces should be in the Storeroom. If pieces are missing, have the student release Gertrude in the Storeroom. The full set of pieces will appear. Then move to the Shape-Edit Room.

Read the instructions aloud. Explain to students that when a playing piece is dropped into the large box on the right, it will be magnified. Then they can add or erase parts of the playing piece in any way they want to. When they are done, they will have a new playing piece they created themselves.

The Shape-Edit Room

Transforming the Playing Pieces Choose one student to move the cursor back to the Storeroom to select one of the primary playing pieces. Then have them move the cursor to the Shape-Edit Room and drop the selected piece in the large box on the right.

Explain the following points to the class:

- The enlarged playing piece changes to black and white.
- The cursor must be moved to the part of the piece that will be changed.
- Pressing **E** (or the top button on the joystick) erases a part of the piece.
- Pressing **SPACEBAR** (or the bottom button on the joystick) adds a part to the piece.
- Changes occur simultaneously in the small box where the piece is displayed in its original size.
- Moving the cursor out of the box automatically moves out the new playing piece.
- When the new playing piece is carried into the Storeroom, it will appear there in four colors.

DEL on IBM

DELETE on Tandy 1000

INS on IBM

INSERT on Tandy 1000

Have students take turns transforming the original playing pieces into a new set. You may want to warn students not to erase a shape completely and move it out of the Shape-Edit Room. If this is done, the corresponding shapes in the Storeroom will also disappear. Then you will need to turn off the computer and reload the program to get the original shapes back. Once students have transformed the four shapes in the Storeroom, have them solve a puzzle using their new playing pieces.

When students play individually or in pairs at the computer, the rest of the class can be involved in the off-line activities.

Off-Line Activities

SNAPSHOTS This is an activity that can be used as part of the classroom presentation of the Shape-Edit Room. While one student transforms a playing piece on the computer, the rest of the class draw the same shape on paper.

sheets, and they color it in. The student at the computer continues moving the cursor from left to right and row by row from top to bottom, naming the locations of rectangles making up the playing piece. When all the locations have been named, have students compare their drawings with the picture on the computer screen. Their pictures should look like snapshots of the playing piece on the screen.

Students can use the grids on the Snapshots activity sheet to design shapes that they will later produce on the computer. They can use the grids to record or save figures they created on the computer.

SENDING BITS AND BYTES Students learn that they can “send” pictures by using computer bits and bytes. They learn to encode pictures by translating the bytes, interpreted as binary numbers (or base 2), into decimal numbers (or base 10).

You need:

- Two activity sheets (pages 31 and 32).
- Pencils or crayons.

Distribute page 31 to the class. Point out that the picture of Gertrude on the left is made up of sixteen rows of seven rectangles each. Explain that each rectangle in the picture represents a bit in the computer's memory and that a bit is the tiniest piece of information that can be handled by a computer. A bit is represented by code using "0" or "1." By putting together sets of bits, information can be transmitted. In this case, it is picture information that is being transmitted.

Now point out that the array to the right of the picture of Gertrude is filled with “0s” and “1s” and that a “1” marks each shaded rectangle in the picture. Tell students that all the art objects in GERTRUDE’S PUZZLES are made up of sixteen rows of rectangles, or 16 bytes. A row of 8 bits of information is called a byte. Gertrude’s bytes, for certain technical reasons, are made up of 7, instead of 8, bits of information.

Sending Bits and Bytes

Translate the Code

NAME _____

54	32	16	8	4	2	1
64	32	16	8	4	2	1
74	32	16	8	4	2	1
84	32	16	8	4	2	1
94	32	16	8	4	2	1

104	32	16	8	4	2	1
114	32	16	8	4	2	1
124	32	16	8	4	2	1
134	32	16	8	4	2	1
144	32	16	8	4	2	1

[illegible]

The Shape-Edit Room

For the second activity, students use letter-number codes to shade the appropriate areas in two different grids to create the pictures.

You need:

- Two activity sheets (pages 25 and 26) for each student.
- Pencils.

Distribute the activity sheets to the class. Be sure students understand the directions.

Coded Pictures NAME _____

Grid A

Use the codes below to draw a picture on the grid. Shade each location that is named by the letter-number codes.

Grid A Codes			Grid A	
B5	D5	F3	9	
B4	D4	F2	8	
B3	D3	F1	7	
B2	D2	G8	6	
B1	E5	G7	5	
C6	E4	G6	4	
C5	E3	G5	3	
C4	E2	G4	2	
C3	F6	G3	1	
C2	F7			
D6	F4			

A B C D E F G

Coded Pictures NAME _____

Grid B

Use the codes below to draw a picture on the grid. Shade each location that is named by the letter-number codes.

Grid B Codes			Grid B	
A6	B8	D8	16	
C8	E3	C9	15	
D14	D6	B6	14	
E16	E5	D11	13	
B15	F1	E8	12	
B3	F7	C5	11	
C14	D5	E7	10	
D9	E4	F3	9	
F15	G5	B5	8	
A5	E1	C7	7	
E14	D3	E9		
F8	E2	B4		

A B C D E F G

In the third activity, students design their own pictures and trade letter-number codes with another student to recreate each other's pictures.

You need:

- One activity sheet (page 27) for each student.
- Pencils.

To vary this activity somewhat, have students duplicate their pictures in the Shape-Edit Room on the computer. They can then use their pictures as playing pieces to solve puzzles.

Coded Pictures NAME _____

Code Exchange

Use this grid to draw your own coded picture. Fill in your letter-number codes below.

		Grid B	
11			
10			
9			
8			
7			
6			
5			
4			
3			
2			
1			

A B C D E F G
Letter-Number Codes

Use this grid to draw your friend's coded picture. Ask your friend to fill in his or her letter-number pairs below.

		Grid B	
11			
10			
9			
8			
7			
6			
5			
4			
3			
2			
1			

A B C D E F G
Letter-Number Codes

Evaluation

Activity sheets may be selected for written evaluation of the objectives learned. In addition, many teachers find that oral evaluation, while students are in front of the computer or looking at an activity sheet, is a quick and effective method. Some suggested questions and instructions are given for each game.

1 The Array Puzzles

- How many shapes appear in each row of a puzzle?
- How many colors appear in each row of a puzzle?
- How are the game pieces in these puzzles arranged?
- What happens if you place a piece in a wrong box?
- If you have arranged all the pieces correctly, what will you see in one column or one row of the completed puzzle?

2 The Loop Puzzles

- How many shapes are used in the puzzles?
- How many colors are used in the puzzles?
- Is it possible for more than one shape to appear in a loop?
- In a two-loop puzzle, what do the puzzle pieces in the middle box have in common with the pieces in the other two boxes?
- How many pieces does Gertrude tell you to place in each box?
- After completing one puzzle, what pattern did you find?
- When solving a two-loop puzzle, why might it be a good idea to drop pieces into the middle box first?

3 The Train Puzzles

- What does Gertrude mean when she says "One line! One difference!"?
- In a one-difference train puzzle, what can you put in a box next to a purple triangle?
- In a two-difference train puzzle, what can you put in a box next to a purple triangle?
- How do the puzzles with one line between the boxes differ from those with two lines between the boxes?
- If all the pieces are in place in a 9-box train puzzle and nothing happens, what does that tell you?
- Is it possible to have more than one solution for a train puzzle?

Evaluation

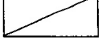
4 The Shape-Edit Room

- How can you change a puzzle piece to create a new one?
- How does the cursor help you to change the shape of a playing piece?
- Describe the new shapes you have formed.

Teacher

School

Year

Class Record Form**Gertrude's Secrets****Computer Experience**Initial-  -Practice

Student Names

	<i>The Tutorial</i>	<i>Gertrude's Puzzle Pieces and the Storeman</i>	<i>The Array Puzzles</i>	<i>The Loop Puzzles</i>	<i>The Train Puzzles</i>	<i>The New Puzzle Piece Room</i>	<i>The Shape-Edit Room</i>
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							
19.							
20.							
21.							
22.							
23.							
24.							
25.							
26.							
27.							
28.							
29.							
30.							
31.							
32.							

Answers

Keyboard Commands, page 1

Apple and Commodore Computers

1. I
2. J
3. K
4. M
5. Spacebar
6. doors
7. wall
8. ESC (Apple)/f1 (Commodore)
9. G (Apple)/S (Commodore)
10. Shift ?

IBM and Tandy 1000

Computers

1. up arrow
2. left arrow
3. right arrow
4. down arrow
5. Spacebar
6. doors
7. wall
8. ESC
9. G
10. Shift ? (IBM)/? (Tandy 1000)

Quiz, page 3

- | | |
|--------------------|--------------------|
| 1. Gertrude's Room | 2. UP |
| 3. 4 | 4. 2 |
| 5. 3 | 6. 2 |
| 7. 7 | 8. 16 |
| 9. UP | 10. No |
| 11. 1 | 12. RIGHT and DOWN |

Complete the Table, page 4

Gertrude's Puzzle Pieces	How many pieces are there?	How many different colors are there?	What are the colors?*	How many different shapes are there?	What are the shapes?***
One-loop Puzzle (Room 4)	9	3		3	
Two-Loop Puzzle (Room 5)	9	3		3	
One-Difference Train Puzzle (Room 6)	9	3		3	
Two-Difference Train Puzzle (Room 7)	9	3		3	
Mixed-Difference Train Puzzle (Room 8)	12	3 or 4†		4 or 3†	
3 × 3 Array Puzzle (Room 9)	9	3		3	
4 × 4 Array Puzzle (Room 10)	16	4		4	

* Colors may be any 3 of the 4 possible colors, or all 4 colors—blue, purple, orange, green.

** Shapes may be any 3 of the 4 possible shapes, or all 4 shapes — diamond, hexagon, square, triangle.

† If there are 3 different colors, there will be 4 different shapes. If there are 4 different colors, there will be 3 different shapes.

Answers

Game Boards, page 7

Solutions may vary.

Game Boards, page 9

Solutions may vary.

Secret Solutions, page 11

Rules may vary.

Secret Solutions, page 13

Rules may vary.

Game Boards, page 15

Solutions may vary.

Game Boards, page 17

Solutions may vary.

Game Boards, page 19

Solutions may vary.

Attributes, page 22

Answers may vary.

Name-A-Pair, page 23

Pictures may vary.

Write a Code, page 24

D15, D14, C13, D13, E13,
C12, D12, E12, B11, C11,
E11, F11, B10, D10, F10, A9,
B9, C9, D9, E9, F9, G9, A8,
B8, C8, D8, E8, F8, G8, B7,
F7, B6, C6, D6, E6, F6, C5,
D5, E5, C4, D4, E4, D3, D2.

Grid A, page 25

The picture is of a dinosaur.

Grid B, page 26

The picture is of a space creature.

Code Exchange, page 27

Pictures may vary.

